CLAIMS

What is claimed is:

1. An apparatus comprising: a microprocessor interconnected for controlling: a means for applying therapeutic pressure exteriorly to selected pressure points on a patient; a means for sensing the patient's electrocardiogram and blood pressure; and a means for setting inception, release, duration, frequency and magnitude of the therapeutic pressure independently at each of the points on the patient.

2. The apparatus of claim 1 further comprising a means for setting a residual pressure upon said release of the therapeutic pressure.

3. The apparatus of claim 2 further comprising a means for sensing residual pressure engaged with the therapeutic pressure applying means under control of the residual pressure setting means.

4. The apparatus of claim 1 further comprising means for selecting a direction of pressure applications on points of a patient, including one of toward the heart and toward the feet of the patient.

5. The apparatus of claim 1 further comprising means for releasing the therapeutic pressure before the inception of one of diastole and systole.

6. The apparatus of claim 1 further comprising means for selecting the points on the patient.

7. The apparatus of claim 1 further comprising means for setting magnitude and duration and therapeutic pressure cycle rate of the therapeutic pressure, absent an electrocardiogram signal.

8. The apparatus of claim 1 further comprising means for recognizing an abnormal heart rhythm and means for adjusting at least one of the therapeutic pressure magnitudes, delay times from the "r" wave of the patient's ECG and durations in accordance with selected cardiac values.

9. The apparatus of claim 1 further comprising means for changing a time interval between therapeutic pressure applications selectively on each of the points on the patient.

10. The apparatus of claim 1 further comprising means for selecting and automatically maintaining a desired peak diastolic pressure to peak systolic pressure ratio by varying the therapeutic pressure magnitude.

11. The apparatus of claim 1 further comprising means for selecting and automatically maintaining a desired peak diastolic pressure to peak systolic pressure ratio by varying the time of inception of therapeutic pressure application from the "r" wave of the electrocardiogram.

12. The apparatus of claim 1 further comprising means for selecting and automatically maintaining a desired peak diastolic pressure to peak systolic pressure ratio by varying the duration of therapeutic pressure application.

13. The apparatus of claim 1 further comprising means for increasing minimum and maximum displayed "qrs" interval.

The apparatus of claim 1 wherein the air pressure applying means is a plurality of remotely actuatable valves in fluid communication with an air reservoir and with each of said valves in fluid communication with one of air bladders disposed within attachment cuffs attached to the points on the patient.

14. The apparatus of claim 1 wherein the bladders are independently inflatable to independently selected levels of therapeutic pressures for independently selected durations and periods of time.

15. The apparatus of claim 14 further comprising a plurality of air actuated valves, each of the air actuated valves engaged with one of the bladders, the air actuated valves engaged in a manner for enabling and inhibiting air flow into the bladders.

16. The apparatus of claim 1 further comprising a higher air pressure source in fluid communication with the plurality of air actuated valves enabling actuation thereof, and a lower air pressure source in fluid communication with the corresponding bladders for inflation thereof.

17. The apparatus of claim 16 wherein the higher air pressure source is in regulatable fluid communication with the lower air pressure source.

19. The apparatus of claim 14 wherein the air pressure applying means includes a remotely actuated valve in fluid communication with one of a mouthpiece assembly with lip cover and nose pinch, an intubation tube and a mask over a patient's mouth and nose.

20. The apparatus of claim 19 further comprising a pressure regulator.

21. The apparatus of claim 19 wherein the one of a mouthpiece assembly with lip cover and nose pinch, an intubation tube and a mask over a patient's mouth and nose further comprises a pressure sensor communicating with a relief valve for inhibiting an overpressure condition.

22. The apparatus of claim 21 wherein the pressure sensor is in communication with the microprocessor for controlling pressure and volume of air infusion.

23. The apparatus of claim 19 further comprising a means for controlling a breath rate and a breath pressure.

24. The apparatus of claim 1 wherein the microprocessor is enabled for controlling the interval between the therapeutic pressure application at each of said pressure points on the patient.

25. A method of applying therapeutic pressure to exterior pressure points on a patient to treat a medical condition, the method comprising the steps of: sensing the patient's electrocardiogram and blood pressure and applying a selected magnitude of air pressure exteriorly to selected ones of the points on the patient during a selected time period during the cardiac cycle.

26. The method of claim 25 further comprising the step of setting a residual pressure and maintaining said residual pressure in bladders engaged within cuffs on the pressure points of the patient.

27. The method of claim 25 further comprising the step of selecting a sequence of therapeutic pressure applications to the pressure points on the patient from one of: toward the heart and toward the feet.

28. The method of claim 25 further comprising the step of selecting a therapeutic pressure application initiation and completion during one of diastole and systole.

29. The method of claim 25 further comprising the step of selecting at least one point of therapeutic pressure application on a patient from the group of pressure points including: the calves, thighs, buttocks, abdomen and chest.

30. The method of claim 25 further comprising the step of selecting a compression rate, compression therapeutic pressure and compression duration for each of the selected points of therapeutic pressure application in the absence of an ECG signal.

31. The method of claim 25 further comprising the step of adjusting intervals between therapeutic pressure applications on points.

32. The method of claim 25 further comprising the step of selecting and auto-maintaining a desired peak diastolic pressure to peak systolic pressure ratio by adjusting the magnitude of the therapeutic pressure application to the points on the patient.

33. The method of claim 32 further comprising the step of automatically adjusting the delay time from the "r" wave of a patient's ECG and the duration of therapeutic pressure application to maintain a selected D/S Ratio.

34. The method of claim 25 further comprising the step of selecting one of an acceptable minimum and maximum qrs width.

35. The method of claim 25 further comprising the step of placing air actuated valves at each of the points on the patent and separately providing therapeutic air pressure application to bladders associated with each of the points on the patent through the air actuated valves.

36. The method of claim 26 further comprising the step of engaging a check valve on each of the air actuated valves to maintain a selected residual pressure in the bladders upon release of therapeutic pressure.

37. The method of claim 25 further comprising the step of applying the therapeutic pressure to the points on a patient, wherein the points are at least one of: the calves, thighs, buttocks, abdomen and chest.

38. The method of claim 25 further comprising the step of applying the therapeutic pressure, wherein at least one of the points is on the chest.

39. The method of claim 25 further comprising the step of applying the therapeutic pressure wherein at least one of the points is on the abdomen.

40. The method of claim 25 further comprising the steps of providing one of: a mouthpiece, a nose pinch assembly, an intubation tube and a mask, over at least one of the patient's nose and mouth; further providing thereon, an air actuated valve and an air pressure regulator; and applying air pressure into the patient's airway at a selected pressure, for a selected period of time and at a selected rate.

41. The method of claim 40 further comprising the step of setting an air pressure volume to be employed with one of the mouthpiece and nose pinch assembly, the intubation tube and the mask.

42. The method of claim 40 further comprising the step of applying an air pressure sensor feedback means for adjusting and maintaining a selected infusion volume.

43. The method of claim 40 further comprising the step of selecting one of a fixed plurality of pressure settings on the air pressure regulator.

44. The method of claim 40 further comprising the step of selecting a breath pressure, and breath rate.

45. The method of claim 25 further comprising the step of selecting a buttocks/chest compression interval time for actuating the application of a therapeutic amount of pressure to each for a selected duration.

46. The method of claim 25 further comprising the steps of selecting a function icon on the display screen; sending a signal to the microprocessor; actuating inflation of selected bladders at the desired points on the patient in a selected order with a selected delay time and compression period and at a selected pressure.

47. The method of claim 46 further comprising the step of actuating at least one air actuated valve and admitting a second relatively lower therapeutic pressure air through at least one air actuated valve to at least one air bladder for applying therapeutic pressure to at least one point on the patient.

48. The method of claim 25 further comprising the step of alternately compressing at least one of the calves, thighs, buttocks and abdomen with the chest of a patient in cardiac arrest for selected time periods and therapeutic pressures in the absence of an ECG signal.

49. The method of claim 25 further comprising the step of controlling the D/S Ratio in the treatment of persons with congestive heart failure and a left ventricular ejection fraction less than about 40% to not exceed the heart's capacity to eject a therapeutic portion of the blood in the heart's ventricles.

50. The method of claim 49 wherein the D/S Ratio is held to not more than 0.7:1 to 0.8:1 during the first five hours of therapeutic pressure application.

51. The method of claim 49 wherein the D/S Ratio is held to not more than 0.8:1 to 0.9:1 during the next five to ten hours of therapeutic pressure application.

52. The method of claim 49 wherein the D/S Ratio is held to not more than 0.9:1 to 1.3:1 during the remainder of 35 hours of therapeutic pressure application.

53. The method of claim 49 wherein the therapeutic pressure application is held to not more frequent than one hour per day.

54. The method of claim 49 wherein the therapeutic pressure application is held to not more frequent than one hour every other day.

55. The method of claim 25 wherein in treating septic shock, at least two of the calves, thighs, buttocks and abdomen of a patient are therapeutically compressed during systole in a sequence moving toward the heart.

56. The method of claim 25 wherein in treating peripheral edema, at least two of the calves, thighs, buttocks and abdomen of a patient are sequentially compressed during one of systole and diastole in a sequence moving in the direction of one of toward the heart and toward the feet.

57. The method of claim 25 wherein in treating a patient, in whom a femoral catheter is deployed, a therapeutic pressure is application only to the calves and thighs of said patient.

58. A system for applying therapeutic pressure to a person to treat a medical condition, the system comprising: a plurality of electrically actuated valves in fluid communication with both a high pressure air reservoir and in one-to-one correspondence, with a plurality of air pressure actuated valves, the electrically actuated valves admitting actuation air pressure to the air pressure actuated valves for opening said air pressure actuated valves; a plurality of inflatable bladders within cuffs engaged at pressure points on the person, the bladders in fluid communication with a low air pressure reservoir through the air actuated valves, thereby functionally enabled for inflation of the bladders when the air pressure actuated valves are open so as to apply pressure to the pressure points on the person through the cuffs; the pressure points including at least one such point on calves, thighs, buttocks, abdomen and chest, of the person.

59. The system of claim 58 further comprising an electrocardiograph having electrodes enabled for attachment to the chest of the person, a plethysmograph enabled for attachment to an extremity of the person and a means for pressure sensing disposed within both the high pressure and low pressure air reservoirs.

60. The system of claim 59 further comprising a microprocessor in electrical signal communication with the electrocardiograph, plethysmograph and the pressure sensing means.

61. The system of claim 60 wherein the microprocessor is enabled for receiving electrical signals concerning heart activity, blood vessel pressure, air pressure, and further enabled for visual display of information related thereto whereby an operator is able to control the operation of each of the air pressure reservoirs and valves in communication therewith, enabling pressure to be applied to the pressure points on the person's body, in such order, at such intervals, commencing at such time during the cardiac cycle, for such periods of time and at such pressures as may be selected.

62. A method for applying therapeutic pressure to a person to treat a medical condition, the method comprising the steps of: controlling a plurality of electrically actuated valves in fluid communication with both a high pressure air reservoir and in one-to-one correspondence, with a plurality of air pressure actuated valves to electrically admit actuation air pressure to the air pressure actuated valves to open said air pressure actuated valves thereby inflating a plurality of inflatable bladders within cuffs engaged at pressure points on the person; applying a low pressure to the bladders from a low air pressure reservoir through the air actuated valves, thereby functionally enabling inflation of the bladders when the air pressure actuated valves are open so as to apply pressure to the pressure points on the person through the cuffs; the pressure being applied to points including at least one such point on calves, thighs, buttocks, abdomen and chest, of the person.

63. The method of claim 62 further comprising the step of attaching electrodes of an electrocardiograph to the chest of the person, a plethysmograph electrode to an extremity of the person and disposing a means for pressure sensing within both the high pressure and low pressure air reservoirs.

64. The method of claim 53 further comprising the step of forming signal communication between a microprocessor and the electrocardiograph, plethysmograph and the pressure sensing means.

65. The method of claim 64 further comprising the steps of: enabling the microprocessor for receiving electrical signals concerning heart activity, blood vessel pressure, air pressure, and further enabling the microprocessor for visual display of information related thereto whereby an

operator is able to control the operation of each of the air pressure reservoirs and valves in communication therewith, enabling pressure to be applied to the pressure points on the person's body, in such order, at such intervals, commencing at such time during the cardiac cycle, for such periods of time and at such pressures as may be selected.

66. The system of claim 65 further comprising the step of alternating pressure between the chest and lower pressure points in the absence of an acceptable ECG.

67. The system of claim 65 further comprising the step of infusing air into the person's airway in the absence of an acceptable ECG.

68. The system of claim 67 further comprising the step of infusing the air at independently selected times, durations and pressures, maintaining a desired D/S Ratio.

69. The system of claim 65 further comprising the step of maintaining a desired D/S Ratio through pressure applications to the points.

70. The system of claim 65 further comprising the step of enabling qrs minimum and maximum.

71. The system of claim 65 further comprising the step of using the electrical signals to adjust the D/S Ratio.

72. A system for therapeutically affecting the circulation of blood in a person to treat a medical condition, the system comprising: a source of high pressure air in fluid communication with a plurality of air pressure actuated valves, each of the valves mounted on, and in fluid communication with, an inflatable bladder disposed within a cuff removeably attached about at least one of the calves, thighs, buttocks, abdomen and chest of the person; a source of low pressure air in fluid communication with said plurality of valves, wherein a constant pressure is exerted against said valves; a microprocessor interconnected for separately controlling the constant pressure in the low pressure reservoir and high pressure reservoir and enabling valve actuation for inflating the bladders in a selected sequence, magnitude of inflation pressure and period of time during a cardiac cycle of the person.

73. A method of treating medical conditions comprising the steps of: compressing at least two of: the feet, the calves, the thighs, the buttocks, the abdomen, and the chest, in a selected order, at a selected magnitude of pressure and for a selected period of time under a regimen of use appropriate for the medical condition being treated.

74. The method of claim 25 further comprising the step of, for a person with congestive heart failure, reducing the patient's target D/S ratio in proportion to the degree the patient's left ventricular ejection fraction is below about 40%.